
Two New Species of *Leymus* (Poaceae: Triticeae) from Qinghai, China

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ABSTRACT. Two new species of *Leymus*, *L. pendulus* and *L. obvipodus*, are described and illustrated. These two species are endemic to Qinghai province, China, occurring at the margins of woodlands, wastelands, mountain valleys, and the bases of walls, at 2280–2900 m elevation. *Leymus pendulus* is unusual in its lax, long, pendent spikes. It is closely related to *L. flexus*, but differs from that species by pendent spikes, longer rachis internodes, and shorter glumes and lemmas. *Leymus obvipodus* is unique in the genus in having all spikelets pedicellate. It resembles both *L. divaricatus* (Drobow) Tzvelev and *L. aristiglumis* L. B. Cai but differs from the former by lanceolate glumes with 1 to 3 nerves, longer spike-like panicles, taller culms, and lanceolate lemmas with 5 obscure nerves and pubescent margins, and from the latter by lax, longer spike-like panicles, pedicellate spikelets with 4 to 8 florets, narrower glumes, and longer, lustrous lemmas.

Leymus, a perennial genus of Triticeae, is widely distributed in the temperate regions of the Northern Hemisphere. It can also be found in South America in alpine belts of tropical or subtropical zones near the equator. Its species grow in a wide range of habitats, usually on mountain slopes, grasslands, margins of woodlands, roadsides, flood beds, and around lakesides, and are highly resistant to cold, drought, alkali, diseases, wind, and rain. Most species of the genus are forage grasses, and some of them are planted over large areas for pasture as they have a high nutritional value. In gross morphology, all members of the genus have well-developed, perennial root systems and are used for soil and sand stabilization. Furthermore, some of these resilient taxa possess the characteristics of long thick spikes and stout caryopses and constitute important gene resources for crop and forage breeding.

Leymus was first described by Hochstetter in 1848. It has been accepted by most recent taxonomists (e.g., Pilger, 1954; Keng, 1959; Tzvelev, 1976; Melderis, 1980; Barkworth & Riley, 1984).

The genus currently includes about 40 species, approximately 20 of which occur in China. The genus is mainly characterized by perennial, usually spreading rhizomes. Basal leaf sheaths of most species become fibrous with age. Inflorescences are erect and spiciform or spicate-paniculiform with single or multiple spikelets at the node. These spikelets bear linear-subulate to lanceolate glumes with 1 to 5 veins, scabrous to pubescent lemmas, awnless or shortly awned at their apex, paleas equal to or slightly shorter than the lemmas. Chromosome numbers are $2n = 28, 42, 56, 70, 84$, and the haplomes are N (Zhang & Dvořák, 1991). The genus has close phylogenetic relationships to *Psathyrostachys*, *Hordeum*, and *Elymus* (s. str.) of Triticeae, as well as *Bromus* and *Brachypodium*, which are outside the tribe (Kuo & Wang, 1981; Wang & Kuo, 1982).

Because of its wide geographic distribution and economic importance, *Leymus* has been the focus of considerable research in recent years (Cai, 1995, 1997). As part of this ongoing work, several specimens and seeds were collected in the Qinghai area of China in autumn 1998. Among this material, specimens belonging to two previously unrecognized species of *Leymus* were found. One of the two new taxa has the slender rachises, long internodes, and pendent spikes that are only found in closely related species of *Leymus*, but it differs from the known species in the characters of spikelet, floret, rhizome, and leaf sheath. The second new taxon, *L. obvipodus*, has spikelets always pedicellate and a paniculate or almost racemose inflorescence that resembles those found in *Bromus* and *Brachypodium* rather than members of the Triticeae. Inflorescences of *L. obvipodus* differ from those found in *Bromus* and *Brachypodium* in their spike-like appearance, with the presence of two spikelets at each node.

Leymus pendulus L. B. Cai, sp. nov. TYPE: China. Qinghai Province: Xining, Nan Mts., near the Xining Botanical Garden, alt. 2320 m, 36°36'N, 101°46'E, 12 Aug. 1998, L. B. Cai & L. Zhi 98022 (holotype, HNWP; isotype, MO). Figure 1.

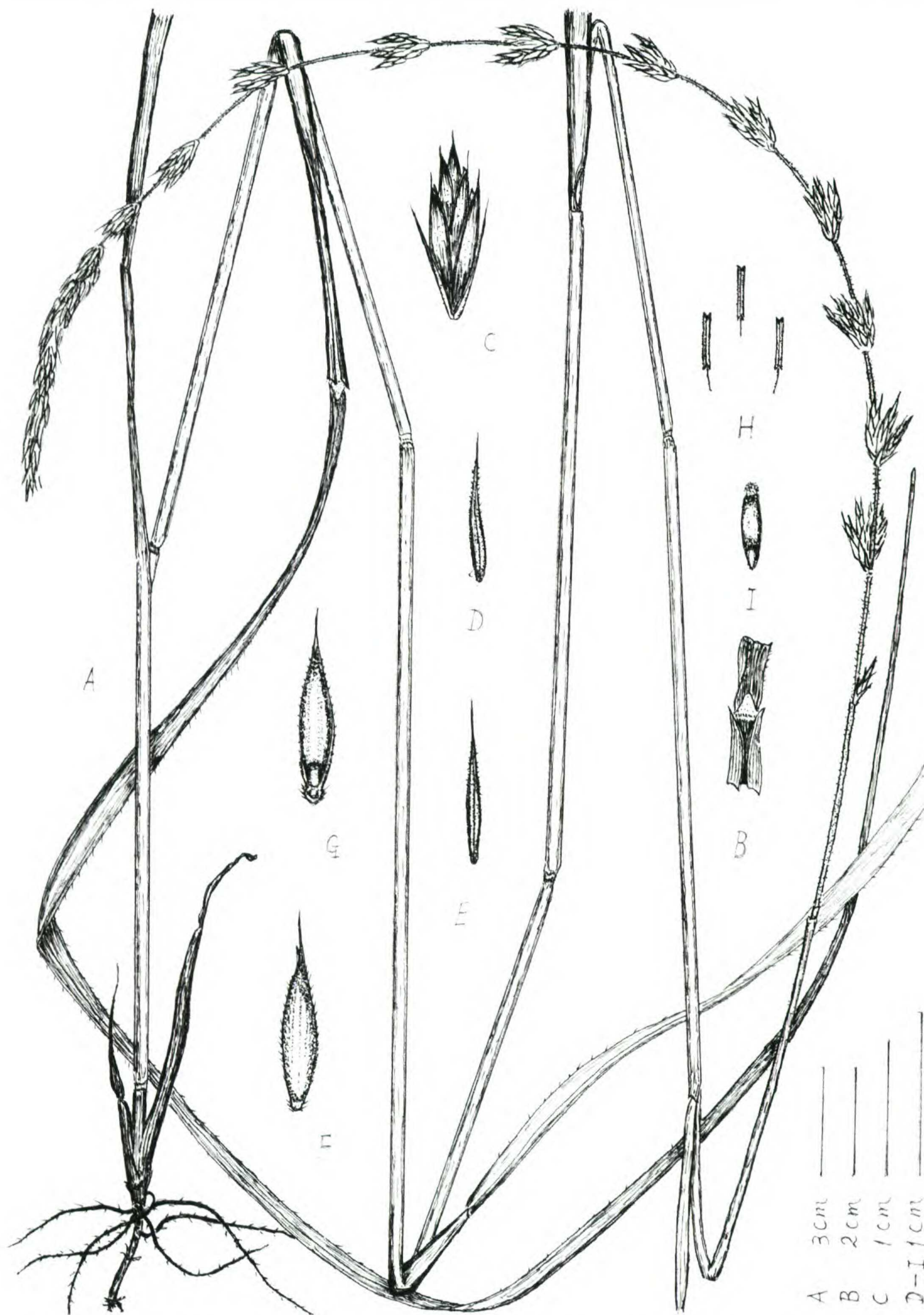


Figure 1. *Leymus pendulus* L. B. Cai. —A. Plant. —B. Junction of sheath and blade to show ligule. —C. Spikelet. —D. First glume. —E. Second glume. —F. Dorsal view of the first floret. —G. Ventral view of the first floret. —H. Anthers. —I. Caryopsis.

Culmi 60–150 cm alti, 4- ad 6-nodes. Spicae 23–32 cm longae, perlaeae, pendulae; rhachidi gracili, partium medianae inferiorisque internodiis plerumque 15–30 mm longis; glumis herbaceis, 9–11 mm longis; lemmate primo 6–9 mm longo (arista exclusa); paleis ad carinas sparsim spinulosis.

Perennial herbs, with extended rhizomes. Culms erect or slightly geniculate below, loosely caespitose or solitary, 60–150 cm tall, ca. 2–3 mm diam., smooth, 4- to 6-noded. Leaf sheaths glabrous or scabrid, the lower ones longer and the upper ones shorter than the internodes, the basal sheaths persistent, sometimes disintegrating into fibers; ligules 2–3.5 mm long, hyaline-membranous, obtuse; leaf blades green, flat or involute, lower blades 22–53 × 0.4–0.7 cm, upper blades 5–15 × 0.2–0.5 cm, both surfaces scabrous, the margins sparsely spinulate or ciliate. Spikes very lax, pendent, brownish, 23–32 cm long; rachis slender, densely pubescent; mid and lower internodes generally 15–30 mm long, the upper ones 6–12 mm long; spikelets usually in twos or threes at each node of the rachis, 5- to 7-flowered, 11–15 mm long; rachilla internodes 1–1.5 mm long, densely puberulent; glumes herbaceous, linear-lanceolate, 1-nerved, scabrid on the back, sparsely ciliate at the margins of upper half, nearly equal, 9–11 mm long; lemmas lanceolate, obscurely 5-nerved, sparsely spinulate on the back, pubescent along or near the margin, the first lemma 6–9 mm long, with a gracile 2–3-mm-long awn at the apex; paleas equal to or slightly longer than the lemmas, apically pointed or bifid, 2-keeled, sparsely spinulate along the keels, scabrous between the keels. Anthers yellow or purplish, 2.5–3.5 mm long. Caryopses brown, ca. 5 × 1.2 mm, pubescent at the apex, adherent to the lemma and palea.

Distribution and habitat. *Leymus pendulus* is known only from the type collections. It is endemic to the eastern part of Qinghai Province, China, where it grows at the margins of woodlands, mountain valleys, and the bases of walls at an altitude of 2280 to 2320 m on soils that are reddish and sandy to clayey.

This species is recognized morphologically from other species of *Leymus* by its slender rachises, long internodes, and pendent spikes. The general appearance of spikes in *L. flexus* suggests some similarity with *L. pendulus*, but *L. flexus* has longer glumes and lemmas, shorter rachis internodes, ciliate paleas, and slightly flexuous spikes. The two species may be easily distinguished by the following key:

1a. Spike pendent, 23–32 cm long; rachis internodes 15–30 mm long in the lower half; glumes her-

baceous, 9–11 mm long; lemma 6–9 mm long (excluding awn); palea spinulate on the keels; culm 4- to 6-noded *L. pendulus* L. B. Cai

1b. Spike slightly flexuous, 15–25 cm long; rachis internodes 8–15 mm long in the lower half; glumes membranous at the margins, 11–14 mm long; lemma 9–10 mm long (excluding awn); palea ciliate on the keels; culm 3- to 4-noded *L. flexus* L. B. Cai

Paratype. CHINA. **Qinghai:** Xining to Datong highway 24 Km, Datong County, alt. 2280 m, 36°49'N, 101°45'E, 2 Aug. 1998, L. B. Cai 9805 (HNWP).

Leymus obvipodus L. B. Cai, sp. nov. TYPE: China. Qinghai Province: Dulan County, Farm Numuhong, alt. 2900 m, 36°29'N, 96°27'E, 25 Aug. 1998, L. B. Cai & L. Zhi 98084 (holotype, HNWP; isotype, MO). Figure 2.

Culmi 40–75 cm alti. Inflorescentia ex panicula spiciformi 8–18 cm longa constans; rhachidi e quoque nodo spiculas unam vel duas manifeste pedunculatas 4- ad 8-floras gerente; glumis lineari-lanceolatis vel lanceolatis, 1- ad 3-nervibus; lemmatibus lanceolatis, nitidis, obscure 5-nervibus, secus vel prope margines pubescentibus, lemmate primo 7–10 mm longo.

Perennial herbs, with extended rhizomes. Culms solitary or loosely caespitose, erect or slightly geniculate below, 40–75 cm tall, 2–3 mm diam., 2- to 3-noded, densely pubescent just below the spike. Leaf sheaths sometimes puberulent, the basal sheaths persistent, becoming fibrous; ligules 1–2 mm long, membranous, obtuse; leaf blades involute, 6–18 × 0.2–0.4 cm, upper and lower surfaces densely puberulent. Spike-like panicles erect, lax, greenish, 8–18 × 0.6–0.8 cm; rachis internodes generally 5–20 mm long or basal ones up to 50 mm, all densely pubescent; spikelets 1 or 2 at each node of the rachis, all pedicellate, 4- to 8-flowered, 11–18 mm long (excluding pedicel); pedicels densely pubescent, 1–14 mm long; rachilla internodes 0.5–2 mm long, densely puberulent; glumes linear-lanceolate or lanceolate, 1- to 3-nerved, glabrous or scabrid on the back, membranous along the margins, gradually tapering into an awn 2–4 mm long; first glume 5–6.5 mm long (excluding awn), second glume 6–7.5 mm long; lemmas lanceolate, lustrous, glabrous or scabrid on the back, pubescent along or near the margins, obscurely 5-nerved; first lemma 7–10 mm long, with a short mucro 1–3 mm long; paleas slightly shorter than the lemmas, 2-keeled, bifid, sparsely spinulate along the keels, glabrous between the keels. Anthers yellowish, ca. 4 mm long. Caryopses brown, pubescent at the apex, ca. 4.9 × 1.1 mm, adherent to the lemma and palea.

Distribution and habitat. *Leymus obvipodus* is

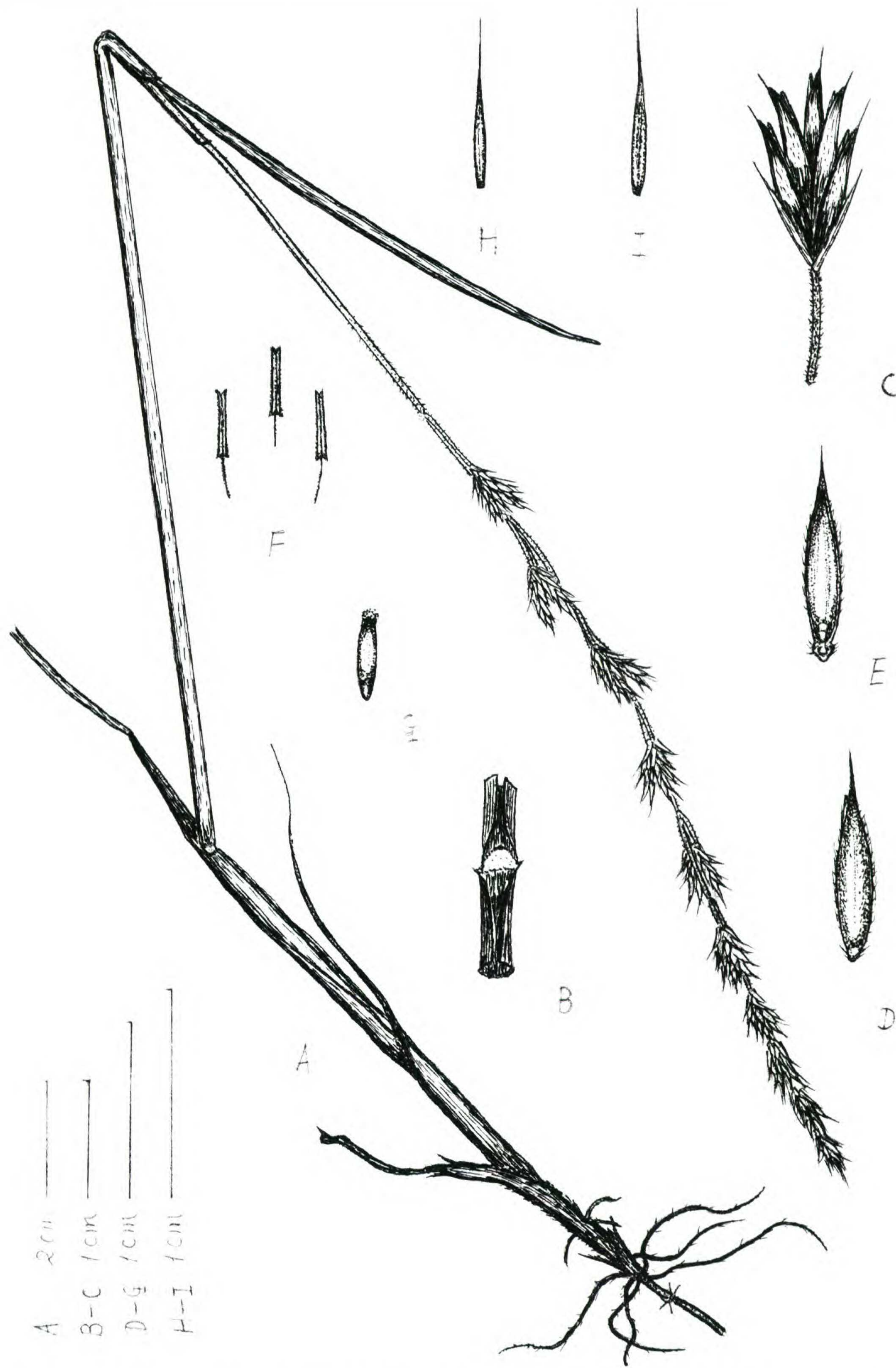


Figure 2. *Leymus obvipodus* L. B. Cai. —A. Plant. —B. Junction of sheath and blade to show ligule. —C. Spikelet. —D. Dorsal view of the first floret. —E. Ventral view of the first floret. —F. Anthers. —G. Caryopsis. —H. First glume. —I. Second glume.

known only from the type collections. It is restricted to the middle and eastern parts of Qinghai province, China, growing at the margins of woodlands and in wastelands at an altitude of 2280 to 2900 m on soils that are blackish and sandy.

This species was initially identified as *Leymus divaricatus*, but differs by its always pedicellate spikelets, lanceolate or linear-lanceolate glumes with 1 to 3 nerves, longer spike-like panicles, taller culms, and lanceolate lemmas with 5 obscure nerves and pubescent margins. In geographic range, moreover, *L. divaricatus* is distributed in central Asia and *L. obvipodus* in China. *Leymus obvipodus* is closely related to *L. aristiglumus* from Qinghai, China, differing by its lax, longer spike-like panicles, pedicellate spikelets with 4 to 8 florets, narrower glumes, and longer, lustrous lemmas. It may be distinguished from these species by the following key:

- 1a. Spikelets 1 or 2 at each node of the rachis, pedicellate or partly pedicellate, 4- to 10-flowered; lemma lustrous, usually 7–10 mm long.
- 2a. Spikelets partly pedicellate; glumes linear-subulate, obscurely 1-nerved; lemma broadly lanceolate, 5- to 7-nerved, glabrous; spike 6–10 cm long; culm 20–40 cm high *L. divaricatus* (Drobow) Tzvelev
- 2b. Spikelets always pedicellate; glumes linear-lanceolate or lanceolate, 1- to 3-nerved; lemma lanceolate, obscurely 5-nerved, pubescent along or near the margins; spike-like panicle 8–18 cm long; culm 40–75 cm high *L. obvipodus* L. B. Cai
- 1b. Spikelets 2 or 3 at each node of the rachis, sessile, 3- to 4-flowered; lemma not lustrous, usually 6–7 mm long *L. aristiglumus* L. B. Cai

Paratype. CHINA. **Qinghai:** Xining to Huang yuan highway 4 km, Xining, alt. 2280 m, 36°36'N, 101°44'E, 30 Aug. 1998, L. B. Cai & B. H. Ma 9828 (HNWP).

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